

On the Occurrence of *Rhomboidella prideaux* (Leach, 1815) (Mollusca: Bivalvia: Mytilidae) in the Eastern Mediterranean

BILAL ÖZTÜRK,* JEAN-MAURICE POUTIERS,** MESUT ÖNEN,* AND ALPER DOĞAN*

*Ege University, Faculty of Fisheries, Department of Hydrobiology, 35100 Bornova, Izmir, Turkey
(e-mail: bilal.ozturk@ege.edu.tr, mesut.onen@ege.edu.tr, alper.dogan@ege.edu.tr)

**Muséum National d'Histoire Naturelle, Département Systématique et Evolution, Unité Taxonomie et Collections
(Mollusques), Case Postale N°51, 55 rue de Buffon, F-75231 Paris cedex 05, France
(e-mail: malaco@mnhn.fr, jampoutiers@free.fr)

Abstract. In a study performed in 2000 on the benthic fauna inhabiting the Turkish coasts of the Aegean Sea, a small less known Mytilidae species, *Rhomboidella prideaux* (Leach, 1815), which has not been reported from the eastern Mediterranean so far, was found. In the present study, the taxonomic, ecological and distributional aspects of this species, based on the material collected from the Aegean Sea and the eastern coast of Sicily, are provided.

INTRODUCTION

Rhomboidella Monterosato (1884:13) is one of seventeen genera of Mytilidae having representatives in the Mediterranean Sea (Sabelli et al., 1990). The genus includes only one Mediterranean species, which is an epibenthic form, living attached to the substrate with its byssal threads. Although some Mediterranean species of Mytilidae (for example some species of *Mytilaster*) are distributed in environments showing greatly reduced levels of salinity (Öztürk et al., 2002) *Rhomboidella prideaux* (Leach, 1815) appears to be a strictly marine species. This tiny species is found mainly along the European and African coasts of the Atlantic Ocean (Berkeley, 1827; Forbes & Hanley, 1849; Tebble, 1966; Segers, 2002) and in the western Mediterranean Sea (Van Aartsen et al., 1984; Salas, 1996; Giannuzzi-Savelli et al., 2001). Here, we report the species from the eastern Mediterranean basin for the first time.

The present study provides new locality records for *R. prideaux* and gives additional information about its ecology and general distribution.

MATERIALS AND METHODS

In the framework of a research realized in 2000 to determine the benthic fauna distributed along the Aegean coasts of Turkey, samplings were carried out at 314 stations in depths ranging from 5 to 200 m. Samples were collected by the R/V Hippocampus, using a dredge capturing a volume of almost 30 dm³. Material was sieved with 0.5 mm mesh and fixed in 4% formaldehyde. In the laboratory, samples were sorted under a stereomicroscope and preserved in 70% ethanol. During the research, specimens of *R. prideaux* were found at only one station located in the southern part of the Aegean Sea (Figure 1).

Dimensions were measured using an ocular micrometer. Species description and morphological terminology follow Cox (1969), amended by Ockelmann (1962, 1983) for early stages of development. As usual for Mytilidae, dimensions were defined as follows: when ventral margin is placed horizontally, length is the maximum size of valves measured according to that direction, and height along a perpendicular direction.

The specimens (one specimen and a valve) are deposited in the Department of Hydrobiology (Ege University, Turkey). Additionally, series housed in the Muséum National d'Histoire Naturelle (MNHN) Paris, were studied by one of us (J.M.P.) for comparison. This additional material was recently collected by diving and dredging during a sampling campaign conducted by MNHN in the Gulf of Catania, eastern Sicily.

RESULTS AND DISCUSSION

Rhomboidella prideaux (Leach, 1815)

Modiola prideaux Leach, 1815:35.

Synonyms: *Modiola rhombea* Berkeley, 1827:229, pl. 18, fig. 1. *Modiola asperula* Wood, S., 1840:252 (nomen nulum); 1851:64, pl. 8, fig. 8.

Other references: *Modiola prideauxiaua*, Brown, 1827: 3, pl. 39, fig. 17; *Crenella rhombea*, Forbes & Hanley, 1849:208–209, pl. 45, fig. 3; *Rhomboidella rhombea*, Monterosato, 1884:13; *Modiolaria (Rhomboidella) rhombea*, Dall, 1898:805; Winchworth, 1932:240; *Crenella (Rhomboidella) prideaux*, Bowden & Heppell, 1966:103, 115; *Crenella prideauxi*, Tebble, 1966:48–49, fig. 19b & 23; *Solamen (Rhomboidella) prideaux(i)*, Soot-Ryen, 1969:276; *Solamen (Rhomboidella) prideauxi*, Bruschi et

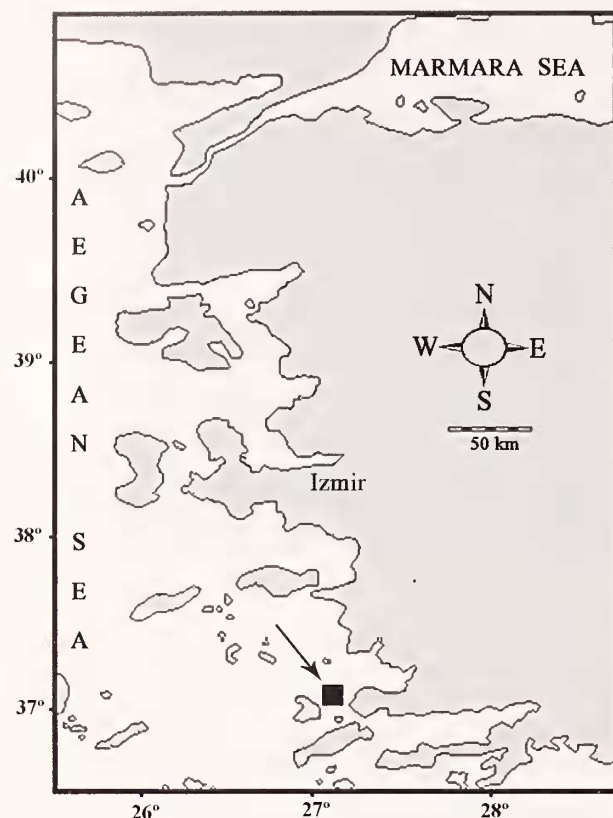


Figure 1. Map of the study area with location of the sampling site where *Rhomboidella prideaux* was found.

al., 1985:48; *Rhomboidella prideaux*, Sabelli et al., 1990: 283.

Material examined: West of Bodrum Peninsula, Turkey (see Figure 1), 36°56'45"N–27°16'32"E, 31 m, 20th September 2000, temperature 22.0°C, salinity 39.1 ppt, dissolved oxygen concentration 4.97 mg/L, sandy substrata with algae fragments, one specimen (1.4 mm long, 1.2 mm high), and a left valve (3.0 mm long, 1.9 mm high) (Figures 2, 3).

Gulf of Catania, eastern Sicily (M.N.H.N., 1990), from North to South: Aci Trezza, Capo Mulini, 37°34.5'N–15°11.9'E, 60–90 m, 5 left valves, 4 right valves; same region, 37°34.5'N–15°20.0'E, 90–120 m, 2 right valves.

Brucoli, Capo Campolato, 37°17.8'N–15°12.8'E, 40–60 m, 1 right valve; same region, Cozzo dei Turchi, 37°17.7'N–15°09.8'E, 15–20 m, 2 left valves; same region, Brucoli Bay, 37°17.3'N–15°11.7'E, 3–9 m, sand bottom with *Posidonia*, 1 left valve, 1 right valve; same region, off Monte Amara, 37°16.5'N–15°13.5'E, 22–25 m, 2 left valves, 2 right valves.

Description: Shell very small (up to about 3.5 mm long), moderately thin for its size, equivalve, well inflated and strongly inequilateral; rounded triangular to obliquely

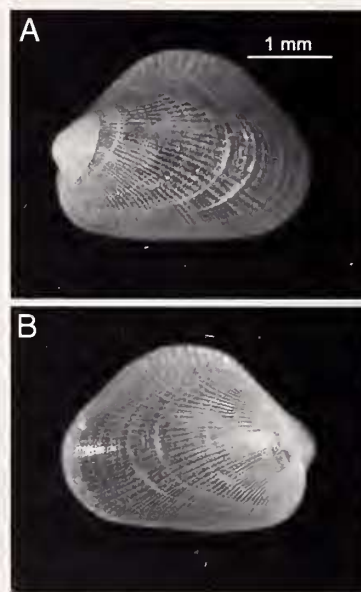


Figure 2. *Rhomboidella prideaux* (Leach, 1815), left valve: A) from the outside, B) from the inside.

rhomboidal in outline. Shape very convex, becoming more or less laterally compressed posterodorsally. Byssal gape poorly developed, a narrow to obsolete slit just anterior to mid-ventral margin of the valves. Umbones prosogyrate, prominent and nearly terminal. Anterior margin short, strongly convex, not extending beyond the umbones. Ventral margin long and straight or nearly so (weakly convex in juvenile stages, tending to be slightly depressed in the middle in mature specimens). Posterior margin large and widely rounded, becoming less convex towards the dorsum. Posterodorsal margin long and slightly arched, oblique in relation to ventral margin, forming a rounded obtuse angle with posterior margin.

Outer surface of valves covered with numerous, densely set radial riblets, slightly diverging on posterodorsal and posteroventral areas, and crossed over by concentric ridges. Radial riblets rounded, about as wide as their intervals, increasing in number with growth by branching or intercalation. Concentric ridges more widely spaced



Figure 3. *Rhomboidella prideaux*, living specimen.

than radial riblets, raised and sharp, most prominent in later growth stages, giving the shell periphery a decussate aspect. Umbonal area with distinct nepioconch and prodissoconch. Nepioconch large (about 680 to 700 μm long), rounded-oblique in outline, sculptured with numerous, conspicuous, incised concentric lines. Prodissoconch large-sized (about 240 μm long), rather convex, D-shaped in outline, slightly more rounded anteriorly than posteriorly, with a narrow and somewhat flattened marginal area (corresponding to prodissoconch II); surface of prodissoconch dull white, roughened by minute dense granulations. Periostracum very thin, adherant, smooth and transparent, resulting in a somewhat glossy and iridescent aspect to the outer shell surface. Shell translucent greyish white in colour, under the pale straw-coloured periostracum.

Ligament inframarginal, not strong, brownish yellow in colour, extending along posterodorsal margin to about two-thirds the distance from umbo to posterodorsal angle; resilial ridge deeply inset, very thin, not pitted. Hinge with a thickened process forming two poorly separated denticles under the beak with tiny, irregular transverse ridges. Shell margin smooth for a short distance just anterior to the beak. Posterior part of hinge line bearing a series of small granules along and behind the otherwise smooth ligamental margin; size of these granulations increasing progressively from umbonal area to posterodorsal angle, where normal crenulations of the valve margins begin.

Interior of shell somewhat glossy and subnacreous, nearly smooth, with the outer sculpture showing through. Muscle scars and pallial line indistinct. Internal margins finely crenulate in accordance with the outer sculpture.

Taxonomic status: *Romboidella prideaux* was first reported from southern England by Leach (1815:35), who briefly described it as *Modiola prideaux* but failed to illustrate it. A figure accompanying this short description was provided much later (Leach & Gray, 1852:333, pl. 12, fig. 9). In the intervening years, the species in question, still included in the genus *Modiola*, has been redescribed and figured by Brown (1827:3, pl. 39, fig. 17) under the emended name of *M. prideauxiana*, or as a different species as *M. rhombea* by Berkeley (1827:229, pl. 18, fig. 1). Wood (1851:64, pl. 8, fig. 8) created *M. asperula* for a Pliocene species from the Crag Formation of England, and this was generally considered as a synonym of *R. prideaux* later on (Glibert & Van de Poel, 1965:79). The species has been placed in other genera, such as *Crenella* (Forbes & Hanley, 1849:208–209; Winckworth, 1932:240; Bowden & Heppell, 1966:103, 115; Tebble, 1966:48–49; Seaward, 1990:69), *Modiolaria* [a junior synonym of *Musculus* (Dall, 1898:805; Lamy, 1937:7)], or *Solamen* (Soot-Ryen, 1969:276).

Though Monterosato (1884:13) pointed out the structural differences between the genus *Modiola* and the shell

characters of this species and introduced the new genus *Rhomboidella* for it, true identity and diagnostic features of *R. prideaux* have been poorly understood, during the following 100 years, as stated by Van Aartsen et al. (1984:58). As a consequence, the systematic position and nomenclatural status of *R. prideaux* has much varied in literature up to recent years. On the assumption that the species name *prideaux* was incorrect (as non latinized), Leach's name has long been either variously emended (as *prideauxi*, *prideauxii*, or *prideauxiana*), or even rejected by different authors. The opinion of major authors of the XIXth century English school (for example Forbes & Hanley, 1849; Jeffreys, 1863) in the use of Berkeley's name *rhombea*, seemed a determining factor in that situation, until Bowden & Heppell (1996:103, 115) gave good reasons to reinstate *prideaux* for the species. However, many authors still use *rhombea* or *prideauxi* (e.g., Poppe & Goto, 1993; Salas, 1996).

Although the shell form and hinge of *R. prideaux* differ completely from those of the genus *Crenella* Brown, 1827, *Rhomboidella* has been often placed in *Crenella* as a subgenus. In addition, *Rhomboidella* was included in the *Solamen* as a subgenus by some other authors as well (Soot-Ryen, 1969; Bruschi et al., 1985). This varying generic allocation reflects the poor understanding of the species and of its genus, as well as its frequent confusion with other mytilid species. For instance, authors dealing with Mediterranean fauna (Parenzan, 1974:55) have followed Nordsieck (1969:30–31), who added to the confusion in considering *R. rhombea* and *R. prideaux* as distinct species, and in distinguishing *Crenella arenaria* Monterosato, 1875 at subspecies level within *R. prideaux*. This situation may have partly arisen from the difficulty of detailed examination of these tiny shells, since their maximum size does not exceed a few millimeters. The outer sculpture of the shell is clearly distinct in specimens of *Crenella arenaria*, owing to the absence of radial riblets in this species (Giannuzzi-Savelli et al., 2001:fig. 189, p. 115).

A correct appraisal of the variability of *R. prideaux* is also necessary for its unambiguous distinction from related species. This species varies in shell form and sculpture. Shape may be variable in length, the posterodorsal angle well-marked to rounded and more or less obtuse. Furthermore, the mid-ventral margin may be straight to somewhat depressed in adult stages. The comprehensive information and drawings provided by Tebble (1966:48–49, fig. 19B & 23) illustrate the variability of shell shape in this species.

The shell shape of the specimens from the Aegean Sea and eastern Sicily are similar to shells from Algeiras Bay, Spain (Van Aartsen et al., 1984:126, fig. 292). Some variation in shape and sculpture may be related to ontogeny. Concentric sculpture tends to be less developed in juveniles, and there is an allometry of growth with a progressive reduction of the height to length ratio. This can

be correlated with a fast growth of the posterior part of shell, the umbones being shifted from a submedian position on the dorsal margin at nepioconch stage to a markedly anterior one in the adult.

Ecology and distribution: The Aegean Sea is an ecologically distinct part of the Mediterranean Sea due to its peculiar hydrographic characteristics. It is an area where the brackish waters of the Black Sea (17‰) communicate with the saline waters of the Eastern Mediterranean Sea (39‰). According to Kocatas & Bilecik (1992), great fluctuations exist among the ecological features such as temperature, salinity and nutrients, in the southern Aegean Sea influenced by the Eastern Mediterranean Sea and in the northern Aegean Sea affected by the Black Sea. This ecological variation affects the flora and the fauna. There are tropical as well as boreal molluscs, but most of the more than 300 bivalve species have an Atlantic-Mediterranean distribution similar to that of *R. prideaux*.

Only scant information on the ecological requirements of *R. prideaux* exists, and most deals with its depth range and preferred substrate. Previously, the species was only reported from the Atlantic Ocean and from the Western Mediterranean region with a mean salinity of 35–36‰. However, the fact that the species has been found in the southern Aegean Sea with a salinity value of 39‰, leads to the conclusion that this species tolerates environmental conditions showing different levels of salinity, like many other species of Mytilidae.

Specimens of *R. prideaux* live attached to the substrate with their byssal threads, like most species of Mytilidae. Berkeley (1827:229) reported a specimen from Weymouth adhering to a large mass of slate by its byssal threads. Nevertheless, living specimens of the species have been reported from different types of substrates, including “coarse bioclots, mud, rocks and gravel, sand, laminaria, algae” (Salas, 1996), and it is not excluded that it can lead an infaunal, superficially buried mode of life, as it has been hypothesized for the West African *R. obesa* Ockelmann (1983:102). The large size of the prodissoconch and the reduction of prodissoconch II, suggests that development in *R. prideaux* is lecithotrophic and possibly direct.

This small sized Mytilid species may live in a range of depths on the continental shelf and possibly the upper slope. Although it is found at a depth of 31 m in the southern Aegean Sea, it is reported from much deeper zones in the Western Mediterranean Sea and the Atlantic Ocean. For example, in the scope of her work on the Bivalve fauna collected during the “Balgim” and “Fauna 1” expeditions in the Alboran Sea, the Gibraltar Straits and the Ibero-Moroccan Gulf, Salas (1996) noted that the species was found living at depths of 12–118 m. In the same work, *R. prideaux* was also found at the maximum depth of 332 m, but only as empty valves.

In the past, *R. prideaux* was reported from the Western Mediterranean and in the Eastern Atlantic, from the British Isles and Ireland (Marshall, 1897) to West Africa. Recent data (Seaward, 1990; Smith & Heppell, 1991) show that the northern limit of the species is in southern England (from Margate, Kent, in the East, to the Sicily Islands and the Bristol Channel in the West) and western Ireland (northwestern Connaught). In the South, it has been reported from Morocco to Santa Helena Island (Gomez Rodriguez & Perez Sanchez, 1997), but its exact distribution is much uncertain because of recurrent confusion with similar *Rhomboidella* species. In that area, it certainly occurs in northern Morocco (Salas, 1996) and probably also in the northern oceanic islands of Madeira and the Canaries, where it co-occurs with *R. canariensis* (Odhner, 1931). It seems to be absent from the tropical coasts of Africa, where *R. canariensis* and *R. obesa* Ockelmann, 1983 are rare and patchily distributed (Rolán & Ryall, 1999; R. von Cosel, personal communication). Easternmost records are the Gulf of Tunis, Tunisia (Weinkauff, 1867:213, 299), Maltese Islands (Cachia et al., 1993) and the western Ionian Sea, in southern Italy (Parenzan, 1961:44) and Sicily (Gulf of Catania, new data).

In recent years, researches conducted in the eastern Aegean Sea and its coastal lakes have contributed to the knowledge of the faunal diversity of that area. Thus, shortly after *Mytilaster marioni* (Locard, 1889) was reported from Bafa Lake by Öztürk et al. (2002), the discovery of *R. prideaux* significantly increased the diversity of the Mytilid fauna in this area.

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